B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

June, 2018

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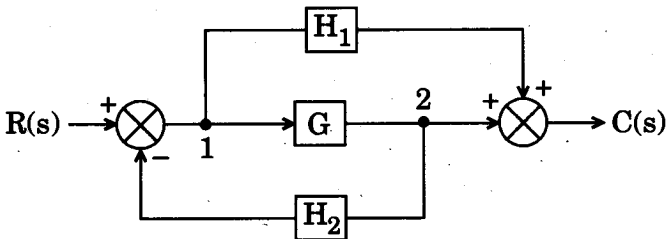### BIEL-020 : CONTROL ENGINEERING

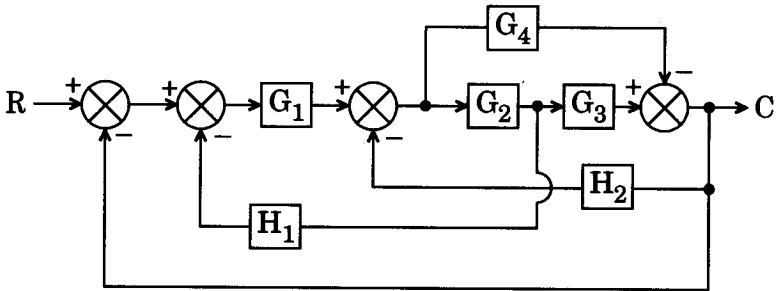*Time : 3 hours*   *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permissible. Use of graph paper and semi-log sheet is allowed.*

1. Determine the ratio C(s)/R(s).   *10*

2. Draw the signal flow graph and determine $\dfrac{C}{R}$ for the block diagram shown below : 10

3. The open loop transfer function of a servo system with unity feedback is given by

$$G(s) = \dfrac{10}{(s+2)(s+5)}$$

Determine the damping ratio and undamped natural frequency of oscillation. What is the percentage overshoot of the response to a unit step input ? 10

4. The open loop transfer function of unity feedback system is given by 10

$$G(s) = \dfrac{50}{(1+0\cdot1\,s)(s+10)}$$

Determine the static error coefficients K_p, K_v, K_a.

5. Sketch the inverse polar plot of

$$G(s) = \dfrac{1+sT}{sT}$$

10

6. Sketch the Bode plot for the transfer function   10

$$G(s) = \frac{1000}{s\,(1 + 0{\cdot}1s)\,(1 + 0{\cdot}001s)}$$

Determine :

(i)   Gain Crossover Frequency

(ii)   Phase Crossover Frequency

(iii)   GM and PM

(iv)   Stability of the given system

7. The characteristic equation of feedback control system is   10

$$s^4 + 20s^3 + 15s^2 + 2s + k = 0$$

(a)   Determine the range of k for the system to be stable.

(b)   Can the system be marginally stable ? If so, find the required value of k and the frequency of sustained oscillation.

8. Sketch the Nyquist plot and determine the stability of a unity feedback control system.   10

$$G(s) = \frac{k}{(1 + sT_1)\,(1 + sT_2)}$$

9. A single input single output system is given as   10

$$X(t) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u$$

$$Y(t) = [\,1 \ \ 0 \ \ 2\,]\,x(t)$$

Test for controllability and observability.

10. (a) What is closed loop transfer function of a system with positive feedback ? Explain the effect of positive feedback on stability.

   (b) Discuss the advantages and limitations of frequency response method of analysis for control systems. *5+5*